

REMARKS/ARGUMENTS

Claims 24-59 are pending. By this Amendment, claims 24, 35, 36, 40, 42-44, 53 and 58 are amended, and new claim 59 is presented. Support for the amendments to claims 24, 35, 36, 40, 42-44, 53 and 58 and new claim 59 can be found, for example, in the present specification at page 1, lines 3 to 18, page 1, line 34 to page 2, line 16, page 6, lines 23 to 29, and page 7, line 26 to page 8, line 6, and in original claims 24, 35, 36, 40, 42-44, 53 and 58. No new matter is added. In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

Objection to the Claims

The Office Action objects to claims 36, 37, 42-44 and 58 as including informalities. By this Amendment, claims 36, 42-44 and 58 are amended to obviate the objection. Claim 37 is objected to solely for its dependency from claim 36. Accordingly, reconsideration and withdrawal of the objection are respectfully requested.

Rejection Under 35 U.S.C. §101

The Office Action rejects claims 42-44 and 58 as reciting unpatentable subject matter under 35 U.S.C. §101. By this Amendment, claims 42 and 58 are amended to obviate the objection. Claims 43 and 44 are objected to solely for their dependency from claim 42. Accordingly, reconsideration and withdrawal of the objection are respectfully requested.

Rejection Under 35 U.S.C. §112, Second Paragraph

The Office Action rejects claims 42-44 and 58 as indefinite under 35 U.S.C. §112, second paragraph. By this Amendment, claims 42 and 58 are amended to obviate the

objection. Claims 43 and 44 are objected to solely for their dependency from claim 42. Accordingly, reconsideration and withdrawal of the objection are respectfully requested.

Rejection Under 35 U.S.C. §102

The Office Action rejects claims 24-28, 31, 35 and 38 under 35 U.S.C. §102(b) over Lilley et al. ("Precipitation in LiF Crystals Doped with MgF₂") ("Lilley"). Applicants respectfully traverse the rejection.

Claim 24 recites "[a]n analyzer, comprising: a monochromator that receives X-ray radiation emitted by a sample and reflects and refracts the X-ray radiation to create diffraction lines; and a detector that receives the diffraction lines and converts the diffraction lines into an electrical signal; wherein: the monochromator comprises a single-crystal lithium fluoride doped with at least 0.018 mol per kg of a divalent positive ion M present in a fluorinated state; and the analyzer is configured to perform elemental analysis of a sample" (emphasis added). Lilley does not disclose or suggest such an analyzer.

As indicated above, claim 24 is directed to an analyzer including a monochromator and a detector. Moreover, the analyzer of claim 24 is configured to perform elemental analysis of a sample. As is well-known to those of ordinary skill in the art, in analyzers that are configured to perform elemental analysis, a sample is irradiated by with primary X-ray irradiation, the sample emits secondary X-ray radiation by fluorescence, a monochromator receives the secondary X-ray radiation, the monochromator reflects and refracts the secondary X-ray radiation to create diffraction lines, and a detector receives the diffraction lines and converts the diffraction lines into an electrical signal. Analyzers for elemental analysis have a very particular structure. Lilley does not disclose an analyzer at all, much less particular components such as the detector recited in claim 24. Lilley is an academic study of a particular doped LiF crystals. *See, e.g., Lilley*, Abstract. Lilley does not remotely

disclose or suggest that such doped LiF crystals could or should be used in an analyzer as recited in claim 24.

As Lilley fails to disclose or suggest an analyzer including a divalent positive ion-doped lithium fluoride monochromator and a detector, Lilley fails to disclose or suggest each and every feature of claim 24.

As explained, claim 24 is not anticipated by Lilley. Claims 25-28, 31, 35 and 38 depend from claim 24 and, thus, also are not anticipated by Lilley. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

Rejection Under 35 U.S.C. §103

A. Lilley

The Office Action rejects claims 29, 30, 36, 37, 45-49 and 53-56 under 35 U.S.C. §103(a) over Lilley. Applicants respectfully traverse the rejection.

i. Claim 24

For the reasons discussed above, Lilley fails to disclose or suggest each and every feature of claim 24.

ii. Claim 45

Claim 45 recites "[a] single-crystal lithium fluoride doped with 0.023 to 0.082 mol per kg of a divalent positive ion M present in the fluorinated state " (emphasis added). Lilley does not disclose or suggest such a fluoride.

As indicated above, claim 45 requires single-crystal lithium fluoride doped with 0.023 to 0.082 mol per kg of a divalent positive ion. While Lilley discloses LiF crystals doped with MgF₂ (see Lilley, Abstract), Lilley does not disclose the particular amount of dopant recited

in claim 45. Moreover, Lilley does not disclose or suggest that selecting particular amounts of a divalent positive ion dopant for single-crystal lithium fluoride within the range recited in claim 45 would provide any particular advantage, much less that selecting such a range of amounts of dopant would provide a desirable effect when the doped lithium fluoride is employed as a monochromator in an analyzer.

While the Office Action asserts that it would have been routine to optimize the amounts of dopant in the LiF crystals of Lilley (*see* Office Action, page 6), it is well-settled, that a particular parameter must first be recognized as a result-effective variable before the determination of workable ranges can be said to be an obvious variation. *See, e.g.*, MPEP §2144.05.II.B (citing *In re Antonie*, 195 U.S.P.Q. 6 (C.C.P.A. 1977)). The Office Action fails to identify, in any of the cited references, recognition that the amount of dopant in stable LiF crystals obtained in Lilley is a result-effective variable. Absent such recognition, one of ordinary skill in the art would not have had a reasonable expectation of success upon manipulating the amounts of dopant in the LiF crystals of Lilley – one of ordinary skill in the art would not have been motivated to optimize those variables, as asserted by the Office Action.

For the reasons discussed above, a *prima facie* case of obviousness has not been made. However, even if a *prima facie* case were made, such case is rebutted by the results shown in the present specification – "[a] *prima facie* case of obviousness ... is rebuttable by proof that the claimed compounds possess unexpectedly advantageous or superior properties." *See* MPEP §2144.09 (citing *In re Papesch*, 315 F.2d 381 (C.C.P.A. 1963)). The Examples of the present specification demonstrate that single-crystal lithium fluoride doped with a divalent positive ion in the amounts recited in claim 45 provides an unexpected effect in comparison with single-crystal lithium fluoride doped with a divalent positive ion in amounts outside the scope of claim 45. *See, e.g.*, present specification, pages 10 to 11,

Tables 1 and 2 (note increased intensities in samples falling within the scope of claim 45).

These results are objective evidence of the improvements of the fluoride of claim 45 in comparison with known fluorides, as in Lilley.

As Lilley fails to disclose or suggest single-crystal lithium fluoride doped with 0.023 to 0.082 mol per kg of a divalent positive ion, Lilley fails to disclose or suggest each and every feature of claim 45.

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As explained, claims 24 and 45 would not have been rendered obvious by Lilley. Claims 29, 30, 36, 37, 45-49 and 53-56 depend variously from claims 24 and 45 and, thus, also would not have been rendered obvious by Lilley. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

B. Lilley and Khulugurov

The Office Action rejects claims 32, 34, 50 and 52 under 35 U.S.C. §103(a) over Lilley in view of Khulugurov et al. ("Laser active F-aggregate colour centres in LiF monocrystals doped by divalent impurity cations") ("Khulugurov"). Applicants respectfully traverse the rejection.

For the reasons discussed above, Lilley fails to disclose or suggest each and every feature of claims 24 and 45. Khulugurov fails to remedy the deficiencies of Lilley. Khulugurov is cited for its alleged disclosure of an LiF crystal doped with Co^{2+} . See Office Action, page 9. However, Khulugurov, like Lilley, fails to disclose or suggest: (a) an analyzer including a divalent positive ion-doped lithium fluoride monochromator and a detector, or (b) single-crystal lithium fluoride doped with 0.023 to 0.082 mol per kg of a

divalent positive ion. Accordingly, the combination of Lilley and Khulugurov fails to disclose or suggest each and every feature of claims 24 and 45.

As explained, claims 24 and 45 would not have been rendered obvious by Lilley and Khulugurov. Claims 32, 34, 50 and 52 depend variously from claims 24 and 45 and, thus, also would not have been rendered obvious by Lilley and Khulugurov. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

C. Lilley and Gupta

The Office Action rejects claims 33 and 51 under 35 U.S.C. §103(a) over Lilley in view of Gupta et al. ("Electrical conductivity studies of cobalt-precipitation in RbCl crystals") ("Gupta"). Applicants respectfully traverse the rejection.

For the reasons discussed above, Lilley fails to disclose or suggest each and every feature of claims 24 and 45. Gupta fails to remedy the deficiencies of Lilley. Gupta is cited for its alleged disclosure of an LiF crystal doped with Zn^{2+} . See Office Action, page 10. However, Gupta, like Lilley, fails to disclose or suggest: (a) an analyzer including a divalent positive ion-doped lithium fluoride monochromator and a detector, or (b) single-crystal lithium fluoride doped with 0.023 to 0.082 mol per kg of a divalent positive ion. Accordingly, the combination of Lilley and Gupta fails to disclose or suggest each and every feature of claims 24 and 45.

As explained, claims 24 and 45 would not have been rendered obvious by Lilley and Gupta. Claims 33 and 51 depend variously from claims 24 and 45 and, thus, also would not have been rendered obvious by Lilley and Gupta. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

D. Lilley and Wittry

The Office Action rejects claims 39 and 57 under 35 U.S.C. §103(a) over Lilley in view of U.S. Patent No. 4,882,780 to Wittry ("Wittry"). Applicants respectfully traverse the rejection.

For the reasons discussed above, Lilley fails to disclose or suggest each and every feature of claims 24 and 45. Wittry fails to remedy the deficiencies of Lilley. Wittry is cited for its alleged disclosure of a fluoride having a surface that is ground, treated in an acidic medium and/or polished. *See* Office Action, page 11. While Wittry appears to disclose that an LiF crystal may be polished (*see* column 10, lines 56 to 67 and column 12, lines 38 to 40), there is nothing in either Lilley or Wittry that suggests that single-crystal lithium fluoride doped with a divalent positive ion could or should be used in an analyzer or include a particular amount of dopant.

As Wittry, like Lilley, fails to disclose or suggest: (a) an analyzer including a divalent positive ion-doped lithium fluoride monochromator and a detector, or (b) single-crystal lithium fluoride doped with 0.023 to 0.082 mol per kg of a divalent positive ion, the combination of Lilley and Wittry fails to disclose or suggest each and every feature of claims 24 and 45.

As explained, claims 24 and 45 would not have been rendered obvious by Lilley and Wittry. Claims 39 and 57 depend variously from claims 24 and 45 and, thus, also would not have been rendered obvious by Lilley and Wittry. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

E. Lilley and Van Loef

The Office Action rejects claim 40 under 35 U.S.C. §103(a) over Lilley in view of Van Loef et al. ("Scintillation Properties of $\text{LaCl}_3:\text{Ce}^{3+}$ Crystals: Fast, Efficient and High-

Energy Resolution Scintillators") ("Van Loef"). Applicants respectfully traverse the rejection.

For the reasons discussed above, Lilley fails to disclose or suggest each and every feature of claim 24. Van Loef fails to remedy the deficiencies of Lilley. Van Loef is cited for its alleged disclosure of a scintillator including a rare-earth halide. *See* Office Action, pages 11 to 12. While Van Loef appears to disclose employing a rare-earth halide as a scintillator (*see* Abstract), there is nothing in either Lilley or Van Loef that suggests that single-crystal lithium fluoride doped with a divalent positive ion could or should be used in an analyzer or include a particular amount of dopant.

As Van Loef, like Lilley, fails to disclose or suggest an analyzer including a divalent positive ion-doped lithium fluoride monochromator and a detector, the combination of Lilley and Van Loef fails to disclose or suggest each and every feature of claim 24.

As explained, claim 24 would not have been rendered obvious by Lilley and Van Loef. Claim 40 depends from claim 24 and, thus, also would not have been rendered obvious by Lilley and Van Loef. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

F. Lilley, Van Loef and Srivastava

The Office Action rejects claim 41 under 35 U.S.C. §103(a) over Lilley in view of Van Loef and U.S. Patent Application Publication No. US 2005/0082484 to Srivastava et al. ("Srivastava"). Applicants respectfully traverse the rejection.

For the reasons discussed above, Lilley and Van Loef fail to disclose or suggest each and every feature of claim 24. Srivastava fails to remedy the deficiencies of Lilley and Van Loef. Srivastava is cited for its alleged disclosure of doping with CeCl_3 . *See* Office Action, pages 12 to 13. However, Srivastava, like Lilley and Van Loef, fails to disclose or suggest an

analyzer including a divalent positive ion-doped lithium fluoride monochromator and a detector. Accordingly, the combination of Lilley, Van Loef and Srivastava fails to disclose or suggest each and every feature of claim 24.

As explained, claim 24 would not have been rendered obvious by Lilley, Van Loef and Srivastava. Claim 41 depends from claim 24 and, thus, also would not have been rendered obvious by Lilley, Van Loef and Srivastava. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

G. Lilley and Ohsugi

The Office Action rejects claim 58 under 35 U.S.C. §103(a) over Lilley in view of U.S. Patent No. 5,220,591 to Ohsugi et al. ("Ohsugi"). Applicants respectfully traverse the rejection.

For the reasons discussed above, Lilley fails to disclose or suggest each and every feature of claim 45. Ohsugi fails to remedy the deficiencies of Lilley. Ohsugi is cited for its alleged disclosure of using a fluoride as a monochromator. See Office Action, page 13. However, Ohsugi, like Lilley, fails to disclose or suggest single-crystal lithium fluoride doped with 0.023 to 0.082 mol per kg of a divalent positive ion. Accordingly, the combination of Lilley and Ohsugi fails to disclose or suggest each and every feature of claim 45.

As explained, claim 45 would not have been rendered obvious by Lilley and Ohsugi. Claim 58 depends from claim 45 and, thus, also would not have been rendered obvious by Lilley and Ohsugi. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

New Claim

By this Amendment, new claim 59 is presented. New claim 59 recites "[a] process for performing elemental analysis of a sample, comprising: exciting the sample with a primary X-ray beam so that the sample emits a second X-ray beam by fluorescence; reflecting and refracting the second X-ray beam into diffraction lines with a monochromator; and detecting the diffraction lines and converting the diffraction lines into an electrical signal with a detector; wherein the monochromator comprises a single-crystal lithium fluoride doped with at least 0.018 mol per kg of a divalent positive ion M present in a fluorinated state" (emphasis added). For at least the reasons discussed above, the cited references, either alone or in combination, fail to disclose or suggest performing elemental analysis using a monochromator having the particular characteristics recited above.

Conclusion

For the foregoing reasons, Applicants submit that claims 24-59 are in condition for allowance. Prompt reconsideration and allowance are respectfully requested.

Respectfully submitted,

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